

THE OSTEOLOGICAL CHARACTERISTICS OF THE FAMILY MURÆ-
NIDÆ.

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In a former communication (Proc. U. S. Nat. Mus., 1890, pp. 157) I have given "the osteological characteristics of the family *Anguillidæ*." I now give those of one of the families most remote from that type and the very great differences between the two will be readily apparent from the comparison of the descriptions and illustrations of the two forms. So great indeed are the differences that Professor Cope has taken the two as types of different *orders* of fishes. No one who bases his views on morphology rather than on superficial resemblance in form will deny that they are at least very distinct families.

MURÆNIDÆ.

Synonyms as families.

- <Ophichthyctes, *Duméril*, Zool. Anal., p. 152, 153, 1806.
- <Anguillide, *Raf.*, Indice d' Ittiol. Sic., p. 37, 1810.
- <Peropteria, *Raf.*, Analyse de la Nature, fam., 1815.
- <Anguilloides, *Latreille*, Fam. Nat. du Règne An., p. 142, 1825.
- <Les Murénides, *Risso*, Hist. Nat. Europe mérid., t. 3, p. 189, 1826.
- <Anguilliformes, *Cuvier*, Règne Animal, t. 2, p. 229, 1817; 2^e éd., t. 2, p. 348, 1829.
- <Murænidæ, *Bonaparte*, Giorn. Accad. d. Scienze, v. 52 (Saggio Distrib. Metod. Animali Vertebr. a Sangue Freddo, p. 34), 1833.
- <Murænidæ, *Bonaparte*, Nuovi Annali delle Sci. Nat., t. 2, p. 133, 1838; t. 4, p. 276, 1840.
- <Murénides, *Agassiz*, Recherches sur les Poissons Fossiles, v. 4, p. [xiii, 2, 12,] 41,* 1843.
- <Murænidæ, *Swainson*, Nat. Hist. and Class. Fishes, etc., v. 2, pp. 195, 333, 1839.
- <Murænoidei, *Müller*, Abhandl. Akad. Wiss. Berlin, 1846, p. 193.
- <Murænidæ, *Bonaparte*, Cat. Metod. Pesci Europei, p. 6*, 38*, 1846.
- <Murænidæ, *Adams*, Man. Nat. Hist., p. 110, 1854.
- <Murænidæ, *Kaup*, Archiv f. Naturgesch., 22 Jg., B. 1, p. 32, 1856.
- <Murænidæ, *Kaup*, Cat. Apod. Fish. B. M., p. 53, 1856.
- <Murænidæ, *Richardson*, Encycl. Brit., v. 12, p. 23, 1856.
- <Murænoidei, *Bleeker*, Enum. Sp. Piscium Arch. Ind., p. xxiii, 1859.
- =Gymnothoracoidei, *Bleeker*, Atlas Ich. Indo-Neerland., v. 4, p. 72, 1864.
- <Murænidæ, *Günther*, Cat. Fishes in Brit. Mus., v. 8, p. 19, 1870.
- <Murænidæ, *Cope*, Trans. Am. Phil. Soc., n. s., v. 14, p. 456 (Oct. 7, 1870), 1871.
- =Gymnothoracide, *Cope*, Trans. Am. Phil. Soc., n. s., v. 14, p. 456.
- =Murænidæ, *Gill*, Arrangement Fam. Fishes, p. 20, 1872.
- =Murænæ, *Fitzinger*, Sitzungsber. k. Akad. der Wissensch. (Wien), B. 67, 1. Abth., p. 45, 1873.

- =Gymnothoracidi, *Pocoy*, Anal. Soc. Esp. Hist. Nat., t. 4 (Enum. Pisc. Cub., p. 10), 1875.
 <Murænida, *Günther*, Int. to Study of Fishes, p. 669, 1880.
 <Murænida, *Moreau*, Hist. Nat. Poissons France, t. 3, p. 574, 1881.
 =Murænida, *Jordan & Gilbert*, Syn. Fishes N. Am., p. 355, 1882.
 =Murænida, *Gill*, Standard Nat. Hist., v. 3, p. 107, 1885.

DIAGNOSIS.

Colocephalous Apodals with conic head, feebly developed opercular apparatus, long and wide ethmoid, posterior maxillines, pauciserial teeth, roundish lateral branchial apertures, diversiform vertical fins, pectoral fins (typically) suppressed, scaleless skin, restricted interbranchial slits, and very imperfect branchial skeleton, with the fourth branchial arch modified, strengthened, and supporting pharyngeal jaws.*

Description.

Body typically anguilliform, subcylindrical forwards, compressed backwards, with the caudal portion gradually attenuated backwards, and with the anus near or in advance of the middle of the length.

Scales absent.

Lateral line generally absent.

Head moderate or small, conic, with all the bones invested in the muscles or skin.

Eyes typically well advanced within the anterior half of the head, directed sideways, of moderate or small size and not covered by the skin.

Nostrils diversiform; posterior in front of or partly above the eyes, anterior near the margin of the snout and generally tubular.

Mouth with the cleft more or less extending beyond the eyes.

Jaws well developed; maxillines far from snout, with the anterior end enlarged and articulating with the oblique truncated lateral extensions of the vomer, and with the clamping processes little developed and not directly appressed to the sides of the vomer, with slight ledge-like extensions behind, but attenuated backwards; mandible moderately stout, but with the dentary elongated, with the coronoid process well developed some distance from its posterior end, the articular little produced externally beyond the condyle (but reaching well forwards internally) and not, or little, extending beyond the condyle backwards.

Teeth diversiform, generally acute and some enlarged, sometimes blunt, generally extending on the shaft of the vomer as on the jaws.

Lips obsolete.

Tongue suppressed.

Periorbital bones moderately developed.

Opercular apparatus reduced; operculum pedunculated and decurved, inserted low down in the hyomandibular; suboperculum interposed be-

* If a still shorter diagnosis be desired, the family be contrasted with all others, so far as known, as *tongueless engyschistous Apodals*, or, again, as *Apodals with the fourth branchial arch limited to the ceratobranchials and epibranchials strengthened and closely applied to elongated pharyngeal bones.*

hind the hinder edge of the operculum; interoperculum small, between the suboperculum and preoperculum; preoperculum small and with muciferous pores.

Branchial apertures lateral and roundish or irregular, generally little nearer the breast than back.

Branchiostegal rays in moderate number ($9-\chi$), concentrated backwards and confined to the epihyals, very slender and much bowed.

Dorsal, anal, and caudal, when developed, confluent in one uninterrupted fin, with all the rays invested in the common integument, and imperceptible without dissection; dorsal diversiform, generally commencing near the head, but sometimes atrophied; anal generally commencing near the anus, but sometimes atrophied; caudal always feebly developed; pectorals generally absent, rarely developed.*

Branchial arches incomplete, without a glossohyal or urohyal, but with the ceratohyals connected directly with the symphysis of the mandible by a ligament; with all the basibranchials and hypobranchials obsolete, the ceratobranchials being united with common cartilage below; ceratobranchials and epibranchials of the first, second, and third arches very slender, of the fourth arch very robust, the ceratobranchials of the fourth arch dislocated upwards and apposed to the hypopharyngeals, as are the epibranchials to the epipharyngeals; pharyngobranchials lost, except one pair which are developed as elongated denticulous epipharyngeals; hypopharyngeals elongated, superposed on the fourth pair of ceratobranchials as are the epipharyngeals on the same pair of epibranchials, the arch thus constituted forming a pair of pharyngeal jaws, behind which is a slender fifth arch; the pharyngeal teeth acute and in one or few rows. Interbranchial slits narrow.

Numerous other osteological peculiarities distinguish this type, but those now given will sufficiently differentiate it from any others.

Inasmuch as there are certain discrepancies between the description here given and the characteristics assigned to the same type by Professor Cope, an explanation seems to be demanded.

Professor Cope has defined the group constituted by the *Murænida* as an order in the following terms:

COLOCEPHALI.

Parietals largely in contact; opercular bones rudimental; the præoperculum generally wanting.† Premaxillary rudimental or wanting; ethmoid very wide. Symplectic, maxillary, pterygoid, basal-branchiyl, superior and inferior pharyngeal bones all wanting, except the fourth superior pharyngeal. This is jaw-like and supported by a strong superior branchiyl; other superior branchiyls wanting or cartilaginous.‡

* *Myroconger* with pectoral fins is placed by Dr. Günther (Cat. Fishes B. M., v. 8, p. 93) in the section of *Murænida engyischta*, characterized by the fact that "the branchial openings in the pharynx are narrow slits," and otherwise composed of typical *Murænida*.

† Pterygoids rudimental or wanting.—Proc. A. A. A. S.

‡ Trans. Phil. Soc., n. s., v. 14, p. 456, 1871. See also Proc. Phil. Soc., v. 13, 1873, p. 25.

In the relations of the parietal and opercular as well as pterygoid bones the Murænids differ from the Anguillids only in degree, and the preoperculum and pterygoid are manifest in the former, although less developed than in the latter. Both want the symplectic. The maxillaries are developed, as Professor Cope later recognized.* The "inferior pharyngeal bones" are also well developed in the Murænids, and, although shifted from the fifth arch to the back of the fourth,† they are evidently homologous with the inferior pharyngeal bones of the true eels and other fishes. "Other superior branchi-hyals" (than the fourth) are not "wanting or cartilaginous" for those of the first three arches are developed in due proportion.

Professor Cope recently has again defined the *Colocephali*,‡ contrasting the group with the *Enchelycephali* (or true eels) and *Lyomeri* by their having "opercular bones, and one osseous branchial arch, ceratohyal," the *Enchelycephali* having "five osseous branchial arches, with ceratohyal."

But the five branchial arches of the Murænids in part at least are also ossified, as well as the ceratohyal (*i. e.* ceratobranchial), and the elements are developed as explained in the full description of the family herewith given.

Professor Cope in his first arrangement (Trans. Am. Phil. Soc., n. s., v. 14, p. 456) recognized only one family of Colocephali, the *Murænidæ*, but under the *Enchelycephali* he had a section (3.) distinguished by having "no pectoral fins; no metapterygoid; pterygoid a slender rod; ethmoid much wider," and the section so distinguished was called the family "*Gymnothoracidæ*." It was later (Proc. Am. Phil. Soc., v. 21, p. 25) stated that the family *Gymnothoracidæ* was a synonym of *Murænidæ*. "Its presence out of place is probably the result of a clerical mistake in not eliminating it from a previous MS., written before the distinction between the orders *Enchelycephali* and *Colocephali* was recognized. As it was inserted under the latter head, its omission from the former was to be understood."

Professor Cope in his later "observations" (Proc. A. A. A. S., 1871, 335, p. 1872) admitted two families in his order *Colocephali*, distinguished as follows:

"A glossohyal and osseous lateral branchi-hyals; four opercular bones; a scapular arch.....	<i>Rataburidæ</i> .
No glossohyal nor osseous branchi-hyals; three or fewer opercular bones; no scapular arch.....	<i>Murænidæ</i> .

The *Rataburidæ* (or *Moringuidæ*) appear to be amply distinguishable

* Proc. Am. Phil. Soc., v. 21, p. 583, 1884.

† Professor Cope later (Proc. Am. Phil. Soc., v. 21, p. 584, 1884) explained that "in the Colocephali all these elements (*i. e.* glossohyal, "basi-hyals, and axial branchi-hyals," etc.) are wanting excepting the fourth superior pharyngeal, which has the form of an antero-posteriorly placed dentigerous jaw, which *opposes the lateral branchi-hyal of the fifth arch, or*, as it is generally called, the *inferior pharyngeal*."

‡ Am. Nat., v. 23, p. 858, 1890.

from the *Muraenidae*, but not by the characters thus given. As already shown, the *Muraenidae* have osseous branchiyls and perfect skeletons, probably, never have fewer than four opercular bones; finally, if *Myroconger* belongs to the family, "a scapular arch" is at least sometimes present. It is in fact represented by cartilage in the typical *Muraenidae*.

Professors Jordan and Gilbert, in their "Synopsis of the Fishes of North America" (1882), have recognized the family *Muraenidae* with the same limits assigned to it by Cope. In their "Analysis of Families of Apodes" (p. 35), they have contrasted the *Muraenidae* in a section (a) characterized by "preopercle wanting; lower pharyngeals wanting; gill-openings very small," with another section (b) distinguished by "preopercle present; lower pharyngeals present." Inasmuch as no such differences exist, the student would be at first thrown off the track in his attempt to identify a muraenoid fish. The characters assigned must not be considered, however, to be the results of independent observations by the authors, for there is good reason to believe that they solely relied upon Professor Cope for the osteological characters mentioned in their description of the family.*

The limits of the family *Muraenidae* are well determined except in the case of the genus *Myroconger*. That genus has been referred to the *Muraenina* by Dr. Günther simply because it is engyschistous. When the extent to which fishes of other families vary in the extent of at least the last branchial slit is remembered, the value of such a character may well be exaggerated. Nevertheless the genus *Myroconger* may be provisionally retained among the Muraenids until its osteology or branchial apparatus is known. Inasmuch, however, as the total suppression of the pectorals is characteristic of the typical *Muraenidae*, and as *Myroconger* has well-developed pectorals "about as long as the snout," which itself is "of moderate length," it may be well to isolate that genus as the representative of a peculiar subfamily (*Myrocongrinae*) and to keep it in abeyance as a doubtful constituent of the family *Muraenidae*.

Not less than twenty-six generic names have been proposed for the family. Many, if not most, of these are undoubtedly superfluous, but there is danger of going to an opposite extreme in reducing the number to three or four (including *Myroconger*), as has been done by Dr. Günther. The course followed by Bleeker and Jordan seems to be the most judicious, and thirteen genera appear to have characters entitling them to such rank. A considerable range of variation is manifested by these genera judging from the external appearance, may be found to be coordinated with good osteological characteristics.

* Professors Jordan and Gilbert, in another place (Syn. Fishes, N. A., p. 82), have frankly acknowledged that "the osteological characters here [there] and elsewhere in this work are mostly taken from Cope's Contribution to the Ichthyology of the Lesser Antilles. Trans. Am. Phil. Soc., 1870."

GENERA OF MURÆNIDÆ.

MYROCONGRINÆ.

(Doubtfully murænid.)

1. MYROCONGER *Günther* Cat. Fishes B. M., v. 8, p. 93, 1870.
Type *M. compressus* Günther.

MURÆNINÆ.

1. MURÆNA *Linn.*
Type *M. helena* Linn.
2. SIDERA *Kaup*, Cat. Ap. Fish, B. M., p. 70, 1856; *Jordan & Gilbert*, Proc. U. S. Nat. Mus., v. 6, p. 209, 1883.
Type *S. picta* (Ahl).
3. PYTHONICHTHYS *Poey*, Repertorio Fis. Nat. de Cuba, v. 2, p. 264, 1868.
Type *P. sanguineus* (Poey).
4. PRIODONTOPHIS *Kaup*, N. ähnl. Fische Hamburger Mus., 1859; *Bleeker*, Atlas Ich. Ind. Néerland., v. 4, p. 74, 1864.
Type *P. ocellatus* Ag.
5. EURYMYCTERA *Kaup*, Cat. Ap. Fish. B. M., p. 72, 1856.
Type *E. schismatorhynchus* (Bleeker).
6. ENCHELYCORE *Kaup*, Cat. Apod. Fish B. M., p. 73, 1856.
Type *E. nigricans* (Bonnaterre).
7. STROPHIODON *McClelland*, Calcutta Journ. Nat. Hist., v. 5, p. 215? 1844; *Bleeker*, Atlas Ich. Ind. Néerland., v. 4, p. 108, 1864.
Type *S. sathete* Ham. Buch.
8. THYRSOIDEA *Kaup*, Cat. Apod. Fish B. M., p. 73, 1856; *Bleeker*, Atlas Ich. Ind. Néerland., v. 4, p. 110, 1864.
Type *T. macrurus* Bleeker.
9. RHINOMURÆNA *Garman*, Bull. Essex Inst., v. 20, p. 114, 1888.
Type *R. quærita* Garman.
10. ECHIDNA *Forster*, "Echirid. h. n. 81," Walbaum, Artedi Gen. Pisc., p. 695, 1792; *Bleeker*, Atlas Ich. Ind. Néerland., p. 77, 1864 = *Pacilophis Kaup*, Cat. Apod. Fish B. M., p. 98, 1856.
Type *E. nebulosa* (Ahl).
11. MURÆNOBLENNA *Lacépède*, Hist. Nat. Poissons, v. 5, p. 652, 1803; *Jordan*, Proc. U. S. Nat. Mus., v. 5, pp. 575, 576, 1883 = GYMNOMURÆNA* *Bleeker, Günther et al* (not *Kaup*).
Type *M. olivacea* Lacépède.
12. CHANNOMURÆNA, *Richardson*, Ich. Erebus & Terror, p. 96, 1847.
Type *C. vittata* Richardson.

* The name *Gymnomuræna* has been used for another genus, viz :

GYMNOMURÆNA *Lacépède*. Hist. Nat. Poissons, v. 5, p. 648, 1803; *Kaup*, Cat. Apod. Fish B. M., p. 103, 1856; *Jordan & Gilbert*, Proc. U. S. Nat. Mus., v. 5, p. 574, 1883.

Type *G. zebra* (Shaw).

The differences between this "genus" and *Echidna* appear to be due chiefly to age, as *Bleeker* has shown.